

Industry and the Power Grid

INFRASTRUCTURE REIMAGINED FACTSHEET

The UN's **Intergovernmental Panel on Climate Change report** declared that in 2019 carbon dioxide concentrations were higher than at any point in the last two-million years, and that governments and society must act decisively to meet the Paris climate goals. Industry and electricity generation are responsible for **almost 40 percent** of total global greenhouse gas emissions. The vast majority of emissions stem from using fossil fuels to generate electricity and run energy-intensive industrial processes. Decarbonizing industry and the power grid requires a rapid transition to electrification powered by renewable and zero-emission electricity. Decarbonizing these sectors will also enable the green energy transition in other essential areas of infrastructure development, such as transportation and green buildings.

Governments and utilities have made investments to modernize and automate the electrical grid, but more needs to be done to improve its flexibility and resilience, increase its capacity and decarbonize the grid through renewables.

As society expands electrical and industrial infrastructure, there is an opportunity to support new innovations, such as smaller, localized power stations, energy storage capabilities and electrified industrial processes.

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COPPER BUILDS SMART, CONNECTED GRIDS POWERED BY RENEWABLES

Governments need to incentivize the use of renewables to power the electrical grid. **China** leads the way in renewable energy power generation, with 29 percent of electricity powered by renewables. The **EU** and the **U.S.** both draw approximately 20 percent of their electricity from renewable energy sources. While progress has been made, further incentivizing the use of renewables in electrical grids, whether through subsidies, directives, financial incentives,

carbon taxes or trading caps, will be an essential part of enabling the energy transition to meet national and international net-zero climate goals. As infrastructure and transportation focus on electrification, renewable energy resources will provide the foundation of a carbon neutral society. Copper supports this process, as everything from the renewable electricity generation to the digital technologies that enable grid systems rely on copper.

- A larger, interconnected power grid is a key step to increase renewable energy, ensure affordable energy prices and guarantee reliability, all of which are essential for industry decarbonization.
- Electrical grid interconnections, including cross-border connections and subsea cables, allow for a greater share of renewable energy in the energy mix. Interconnecting electrical grids would allow regions with excess generation to send their electricity further away to keep supply and demand balanced.
- Similarly, microgrids, which are localized grids that can disconnect from traditional grids to operate independently, can enable additional localized renewable energy use and alleviate grid disturbances, **strengthening grid resiliency** and allowing for faster system responses.



- Smart grids are an emerging solution that promise to further increase efficiency, reduce electricity consumption and balance the electricity supply. By digitalizing the homes, offices and industries connected to the grid, power can be more efficiently allocated, and waste can be reduced.
- A recent International Energy Agency (IEA) **report** shows a significant amount of copper is used in many key renewable energy technologies: offshore wind turbines typically need 4,000 kg/8,819 lb of copper per MW installed, onshore wind requires around 3,000 kg/6,614 lb and photovoltaic panels use around 2,500 kg/5,512 lb per MW of capacity.

EFFICIENT ELECTRICITY TRANSFER

An important part of the energy supply process is transmitting energy after generation to the consumer. In the U.S., five percent of energy is **lost in transfer** between generation and end use, and in the EU, that number rises to eight percent. Copper contributes to efficient energy transfer from generation to the consumer.

- The U.S. electric transmission network contains more than 600,000 circuit miles of lines, of which 240,000 are high-voltage lines. Copper is a **key material for transmission** and is used in structural frames, conductor lines, cables, transformers, circuit breakers, switches and substations.
- Copper is used in underground power transmission and is a preferred material due to its high levels of electrical and thermal conductivity, strength, pliability and resistance to corrosion. Underground lines also have reduced maintenance costs, protection from weather and longer life expectancies.

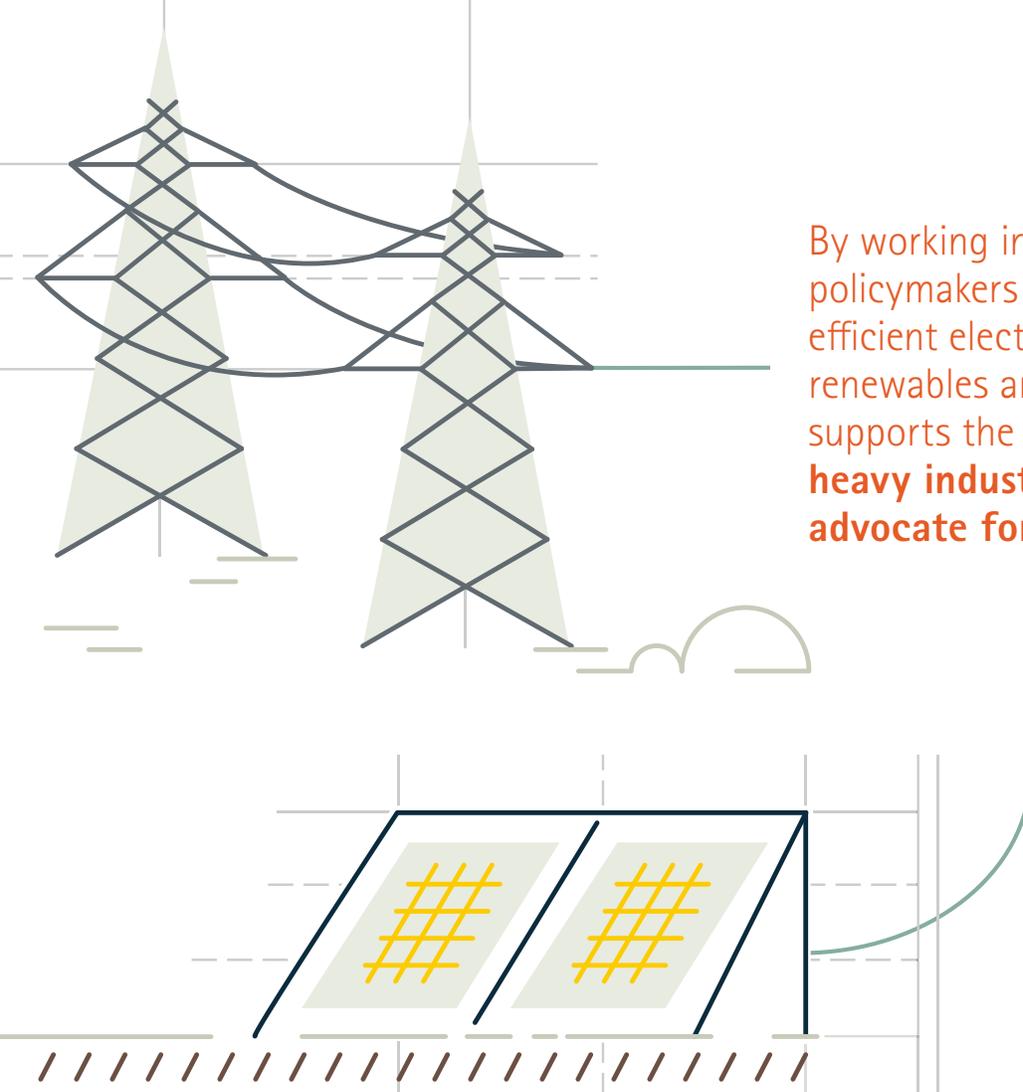


By storing energy from renewables to meet future energy needs through battery energy systems, storage can smooth the electricity supply's variability without need for fossil-fuel-powered backup.

ENERGY STORAGE PROVIDES FLEXIBILITY

Maximizing the potential of energy storage systems ensures a greater use of renewables in the energy mix and provides flexibility to meet demand. Energy storage is the largest missing link to delivering a carbon-free electrical grid. By storing energy from renewables to meet future energy needs through battery energy systems, storage can smooth the electricity supply's variability without need for fossil-fuel-powered backup.

- Increased growth of energy storage could result in growth in demand for copper in North America alone of **6,000 tonnes per year by 2027** with commensurate increases around the world. Copper is used in many applications to connect energy storage and generation to the electrical grid and can be found in transformers, breakers, switches, monitoring systems and inter- and intra- system wiring.
- Battery energy storage systems offer **incentives for renewable energy use** for power operators, as it would be in the best interest of system operators to use lower-cost, emissions-free renewable energy generation. Using periods of excess renewable generation to charge a battery can reduce renewable energy source (RES) curtailment and maximize value for developers.
- Large-scale energy storage, particularly from batteries, is rapidly dropping in price as battery technology improves. **According to the International Energy Agency**, the world will reach 400 GW of energy storage by 2040, 220 GW of which will come from batteries.
- Distributed energy storage, with smaller batteries in houses, offices or businesses, allows customers to store the power from their own on-site renewable generation, which can decrease costs, increase grid efficiency and improve protection from grid outages.
- Other electrified technologies can combine with each other to create synergistic effects. Electric vehicles can serve as grid storage batteries while plugged into a smart grid, creating the potential to vastly increase storage capacity and improve the efficiency of the grid.



By working in tandem with policymakers to maximize energy-efficient electrification powered by renewables and develop policy that supports the renewable transition, **heavy industries can be a powerful advocate for the energy transition.**

ELECTRIFYING ENERGY-INTENSIVE INDUSTRIES

Electrification of energy intensive industries is key to bringing global emissions down to net-zero.

- Electrification of industry is crucial to meeting the challenge of climate change. In the EU, for example, current trends project electrification of the energy system to remain below 25 percent by 2030, while the **Electrification Alliance suggests** this needs to be well above 35 percent by 2030 and up to 60 percent or more by 2050.
- According to **McKinsey**, industry consumes more energy than any other sector. By transitioning to electrification, heavy industry could implement more energy-efficient operations with lower maintenance costs and with few major fundamental changes to machinery or equipment. McKinsey estimates that 50 percent of fuel used for operations could be converted to electricity, significantly reducing global GHG emissions.

- Heavy industry companies and site operators can invest in R&D strategies to adopt current industry technologies to run on electricity. By working in tandem with policymakers to maximize energy-efficient electrification powered by renewables and develop policy that supports the renewable transition, heavy industries can be a powerful advocate for the energy transition.
- Copper plays a critical role across every stage of this industrial electrification by enabling renewable energy generation technologies, connecting the grid infrastructure to society and playing an integral role in the electrified industrial machinery itself.

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